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## SPATIAL DIVERSITY OF THE ATTRACTIVENESS OF RURAL COMMUNES FOR ENTERPRISE DEVELOPMENT IN POLAND

Key words: enterprise development, economic attractiveness, socio-economic development, rural communes, synthetic index

**ABSTRACT.** The aim of this paper is to evaluate the spatial diversity of rural communes in Poland from the point of view of their attractiveness for enterprise development. Empirical analyses were preceded with a comprehensive literature review and a study of available diagnostic tools. Based on their earlier experience, the authors decided to apply the conception of the synthetic measure of attractiveness for the purpose of an empirical study conducted with reference to time and space. The source material was selected information regarding rural communes in Poland, obtained from the Central Statistical Office (GUS), Local Data Bank. Empirical verification was based on the synthetic indexes of entrepreneurship ( $u_{ip}$ ) and rural commune attractiveness  $u_{iA}$ . They were constructed using the non-model measure method, which is the arithmetical mean of normalized features. The results are presented in tables and on maps. Research results clearly indicate that the number of economic entities in rural *communes* has systematically been growing from year to year. A positive, statistically significant correlation of moderate power was found between the indicators. Also, a positive correlation (statistically significant and of moderate power) was found between commune attractiveness and the spatial distribution of the number of economic entities. Moreover, based on the regression model, it was ascertained that the number of economic entities is most strongly determined by factors such as migration balance, housing conditions and the percentage of budget expenditure on investment.

### INTRODUCTION

For years, it has been agreed that the sustainable development of rural areas requires reinforcing existing activity and creating new ways of generating new jobs and stimulating economic growth [OECD 2018, Kłodziński 2015]. The new ways include improving the inhabitants' education and skills, encouraging people to introduce innovations and develop non-agricultural activity. This, in turn, requires improving technical, social and institutional infrastructure systems (i.e. a broadly understood business environment) [Wach 2015], as well as stimulating social capital at a local level [Kozera 2011, Kotarski 2014, Kłodziński 2015]. Stimulating the balanced development of the country, however, still remains a challenge for state policy, which shows in the development disproportions between rural areas and cities, together with the areas surrounding them [Rosner, Stanny,

2007, Właźlak, 2010]. It is connected with considerable spatial differences as regards access to, so called, framework conditions for enterprise development: the availability of capital, support programs, the effective transfer of knowledge and technology, as well as the effective migration of workers [Niewęglowski et al. 2016].

The article presents a continuation of the authors' earlier research regarding the uneven development of rural areas as the inhabitants' working and living environment, in the context of the ongoing exodus of young people from these areas. The literature on the subject includes publications in which authors analyse factors influencing enterprise development in Poland, but usually concentrate on one region or voivodeship. Although other studies, conducted at a voivodeship level, enable researchers to make international comparisons (also with EU countries), they still do not enable a detailed analysis of relationships at a micro-level, i.e. in communes. Therefore, the aim of the article is to evaluate the spatial diversity of rural *communes* in Poland from the point of view of their attractiveness for the development of economic activity. Due to limitations regarding the length of the article, the authors decided to only present selected findings (i.e. the study results for 2015 and 2018), relevant to the aim they set themselves.

## MATERIAL AND METHODS

The attractiveness of rural areas is a complex phenomenon, defined by a number of factors. It includes successful economic undertakings, the effects of which will contribute to economic growth in social, economic and environmental dimensions [Sobala-Gwosdz 2004], it is also identified with a favourable location that promotes development [Brambert 2011]. As a result, we can observe growing interest in these areas as places to live, work and run business activities [Uglis, Kozera-Kowalska 2019].

The analysis included 25 variables, divided into stimulants (S) and destimulants (D), which were typical of processes occurring in the economic and social sphere, environmental protection and the finances of rural communes in Poland. The source materials used in the study was data regarding rural areas in 2015-2018.

Due to the complex relationship between the attractiveness of rural areas and the development of economic activity, the study was divided into two stages. Stage one included an analysis of the entrepreneurship level. For this purpose, a synthetic index of entrepreneurship ( $u_{ip}$ ) was constructed. In the literature, many diagnostic variables are used to describe the phenomenon of entrepreneurship [Martins 2007, Klaper et al. 2007, GUS 2019]. In order to do that, the authors decided to use four diagnostic variables *ut infra*: (x1) the number of economic entities featured in the REGON register per 10,000 inhabitants (S), (x2) the total number of economic entities in the country per 1,000 inhabitants of productive age (S), (x3) the number of economic entities newly entered into the REGON register per 10,000 inhabitants (S) and (x4) the number of entities removed from the REGON register per 10,000 inhabitants (S).

At stage two, diagnostic variables were chosen to define the commune attractiveness for enterprise development. A set of 21 variables were selected for analysis: ( $X_1$ ) population density (S), ( $X_2$ ) internal and external migration balance per 1,000 inhabitants (S), ( $X_3$ ) the number of unemployed per 10,000 people of productive age (D), ( $X_4$ ) the demo-

graphic dependency ratio – the number of people of non-productive age per 1,000 people of productive age (D), ( $X_5$ ) forest cover in % (S), ( $X_6$ ) environmental attractiveness, i.e. the percentage of the area protected by law (S), ( $X_7$ ) the percentage of people using a sewage treatment plant (S), ( $X_8$ ) water supply network density in km/100 km<sup>2</sup> (S), ( $X_9$ ) sewage network density in km/100 km<sup>2</sup> (S), ( $X_{10}$ ) gas network density in km/100 km<sup>2</sup> (S), ( $X_{11}$ ) the percentage of dwellings connected to the sewage system (S), ( $X_{12}$ ) the percentage of dwellings connected to the water supply system (S), ( $X_{13}$ ) the percentage of dwellings with bathrooms (S), ( $X_{14}$ ) the percentage of dwellings with central heating (S), ( $X_{15}$ ) a commune's budgetary income in PLN per inhabitant (S), ( $X_{16}$ ) a commune's own income in PLN per inhabitant (S), ( $X_{17}$ ) a commune's total expenditure in PLN per inhabitant (S), ( $X_{18}$ ) the percentage of expenditure on investment in total budget expenditure (S), ( $X_{19}$ ) the number of pharmacies and dispensaries per 1,000 inhabitants (S), ( $X_{20}$ ) the number of overnight accommodation places (S) and ( $X_{21}$ ) the number of primary schools per 1,000 inhabitants (S).

In order to construct the entrepreneurship index ( $u_{ip}$ ) and the rural commune attractiveness index ( $u_{iA}$ ), the authors used the method of non-model measure, which is the arithmetical mean of normalized features and can be written down as [Uglis, Kozera-Kowalska 2019]:

$$u_i = \frac{1}{p} \sum_{j=1}^p z_{ij} \quad i = 1, \dots, p$$

where:  $u_i$  – the synthetic index,  $p$  – number of variables,  $z_{ij}$  – value of the normalized variable  $j$ -th in the  $i$ -th observation.

Applying a synthetic index requires the values of all variables to be expressed in the same units within the same order of magnitude [Strahl, Walesiak 1997, Pawełek 2008, Walesiak 2014]. To select the standardization method, calculations were carried out with four standardization formulas [Uglis, Kozera-Kowalska 2019]. Analysis of variance showed the lowest dispersion of the obtained synthetic meter values using the unitarization formula [Młodak 2006]:

– for the stimulants:

$$z_{ij} = \frac{x_{ij} - \min x_{ij}}{\max x_{ij} - \min x_{ij}}$$

– for the destimulants:

$$z_{ij} = \frac{\min x_{ij} - x_{ij}}{\max x_{ij} - \min x_{ij}}$$

where:  $z_{ij}$  is the value unitarized variable  $j$ -th in the  $i$ -th observation,  $\max x_{ij}$  – the highest value of the  $j$ -th variable,  $\min$  – lowest value of the  $j$ -th variable.

The aspects considered when choosing the diagnostic features included factual, and statistical considerations (the coefficient of variation was at least 10%), as well as data availability at a level of communes under study. During the study, the features for which the coefficient of variation was lower than 0.1 were eliminated.

In order to establish homogenous groups of rural communes depending on the synthetic index, four categories of attractiveness were distinguished based on the arithmetical mean and standard deviation.

Other methods applied in the study included multiple regression analysis and discrimination analysis. Statistical calculations were made using the Statistica 13.3 program.

## RESEARCH BACKGROUND

Rural communes are self-governing administrative units in Poland, which only include rural localities. As of 1<sup>st</sup> January 2020, they covered 192,225 km<sup>2</sup>, which makes up 61.5% of the total area of the country. Rural communes are inhabited by 10.9 million people, which is 28.5% of the country's population. It should be mentioned that due to various development processes, the number of rural communes in Poland has been decreasing in recent years. Between January 2000 and January 2020, their number decreased by 66 (from 1,599 to 1,533). That change was the outcome of a number of socio-economic factors, such as the inflow of foreign capital, the outflow of the population from rural areas, which was only partly compensated by an inflow of migrants from cities, an enlargement of suburban zones or gaining municipal rights by rural localities [Żróbek-Różańska, Zysk, 2015, Kozera-Kowalska, 2018, Wilkin 2020].

The factual material which was analysed included data regarding rural communes in accordance with the territorial division of Poland in 2015 (1,563 communes), 2016 (1,559 communes), 2017 (1,555 communes) and 2018 (1,548 communes). The number of communes over that period decreased by 16, with the biggest drop in 2018 (compared to the preceding year). Rural communes vary considerably as regards the number of inhabitants and territory. The least populated is the Dubicze Cerkiewne commune in the Podlaskie voivodeship (1,524 inhabitants), and the most populated one is Długołęka commune in the Dolnośląskie voivodeship (over 32,100 inhabitants).

Entrepreneurship in rural areas is considered to be a key factor and, at the same time, an indicator of the economic development level [Stańko 2009, Wach 2015, Sołtys 2016]. In the opinion of Jerzy Bański [2016], rural entrepreneurship should take advantage of local socio-economic and natural assets, which will increase the functional diversity and revenue of rural homesteads. The idea fits into the concept of intelligent entrepreneurship development in rural areas [Wójcik 2018, Wójcik et al. 2018, Wojewódzka-Wiewiórska et al. 2020], where the economic activity of countryside dwellers becomes a necessary condition to achieve economic success and increase the attractiveness of rural areas as a place to live and work.

Data analysis regarding local economic entities operating in rural areas shows that their number increased from 821,700 in 2015 to 885,300 in 2018, and the mean annual growth rate in that period was 2.5%. They made up 20.3% of the overall number of economic entities in Poland, in 2018. A high level of economic activity was mainly confirmed in communes situated close to large cities (e.g. Tarnowo Podgórne – 213,100) and in attractive tourist areas (e.g. Rewal – 371,100). Much weaker economic activity was recorded in communes situated far from urban centres, e.g. Nowy Dwór (28,300), which confirms the findings of other author's research, conducted on a regional level [Salamon 2009, Kraska 2013, Nowak 2013, Niewęglowski et al. 2016].

## RESEARCH RESULTS

The subject of study was the assessment of the attractiveness of rural communes as an enterprise development area. This article presents the results of research conducted for 2015 and 2018. Following the methodology they adopted, the researchers first analysed data regarding the entrepreneurship development level. Table 1 presents the statistics describing the diagnostic variables used in the analysis.

Table 1. Selected descriptions of enterprise development diagnostic variables

Specification	2015 (n = 1,563)				2018 (n = 1,548)			
	x1	x2	x3	x4	x1	x2	x3	x4
Mean	689.0	109.4	65.0	53.0	739.0	119.2	81.0	51.0
Median	638.00	101.4	60.0	50.0	689.0	111.2	76.0	47.0
Standard deviation	261.5	40.7	29.0	24.7	267.4	43.1	29.7	21.9
Max.	3,529.0	563.2	340.0	304.0	3,711.0	601.3	380.0	283.0
Min.	278.0	45.9	9.0	4.0	283.0	45.5	18.0	8.0

Source: own study

While analysing the data on a voivodeship level, the maximum values of features x1 and x2 were found in the Zachodniopomorskie Voivodeship in both years in question, and of feature x3 – in the Mazowieckie (2015) and Małopolskie (2018) voivodeships. The highest value of variable x4 was found in two voivodeships: Zachodniopomorskie and Małopolskie. The lowest values of variables x1, x2 and x3 in both years were found in the Podlaskie Voivodeship and of variable x4 – in the Lubelskie and Świętokrzyskie voivodeships. Taking the coefficient of variation values into account, it was discovered that the strongest diversity of variables in 2018 occurred in the Zachodniopomorskie communes, while the least diversified communes included those in the Opolskie (x1), Świętokrzyskie (x2), Śląskie (x3), and Lubuskie (x4), voivodeships.

Based on selected diagnostic variables describing the level of rural entrepreneurship and treated as equal, a synthetic index of entrepreneurship ( $u_{ip}$ ) was constructed. The indicator values allowed the author to establish a hierarchical classification of rural communes with respect to the synthetic measure ( $u_{ip}$ ). Using the arithmetical mean and standard deviation, four homogenous groups were identified, which comprised units representing indicator values within the following ranges (Table 2).

Table 2. Referential values of the entrepreneurship synthetic index ( $u_{ip}$ )

Group	2015 (n = 1,563)		2018 (n = 1,548)	
	range	% of communes	range	% of communes
A	$u_{ip} \geq 0.357$	10.1	$u_{ip} \geq 0.364$	11.0
B	$0.357 > u_{ip} \geq 0.314$	30.8	$0.364 > u_{ip} \geq 0.321$	31.2
C	$0.314 > u_{ip} \geq 0.271$	51.2	$0.321 > u_{ip} \geq 0.278$	49.2
D	$0.271 > u_{ip}$	7.9	$0.278 > u_{ip}$	8.6

Source: own study

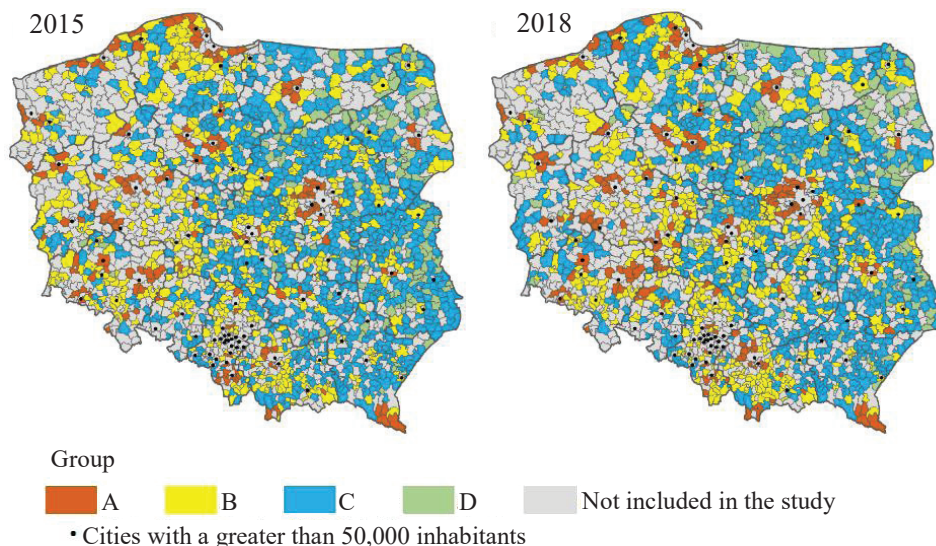


Figure 1. Spatial distribution of the synthetic index of entrepreneurship in 2015 and 2018

Source: own study

The distribution of entrepreneurship synthetic index groups is presented in Figure 1. When analysing the distribution of communes by these groups, it was found that over half of them were included in groups C and D in both rankings. Considering the fact that over 50% of communes, voivodeship-wise, belonged to groups A and B, we should point to a slight change: in 2015, this condition was met by communes in seven voivodeships, while in 2016 – the Lubuskie Voivodeship disappeared from this group. Among the six voivodeships with the largest percentage of communes from groups C and D (over 2/3), similar changes were not confirmed in any of the years in question.

After analysing the results of linear ordering, it can be contended that over half of the communes included in the study (51.2%) improved their position in 2018, compared to 2015. Only the position of three communes did not change. As regards the remaining communes, the entrepreneurship index value decreased. In 2018, its highest values were recorded in the top 10 of rural communes: Rewal, Lesznowola, Ustronie Morskie, Suchy Las, Kobierzyce, Tarnowo Podgórne, Dobra (Szczecińska), Nadarzyn, Komorniki and Dopiewo. The lowest values were recorded in Wysokie, Markusy, Gzy, Lelkowo, Grodzisk, Stromiec, Nurzec-Stacja, Nowy Dwór, Czyże and Orla. The results confirm [Bański 2016] that above-average economic activity occurs, first of all, in communes adjacent to large cities (Warsaw, Poznań, Wrocław and Szczecin) and in attractive tourist areas, e.g. the coastal area.

An analysis of Pearson's correlation coefficient between the number of economic entities per 1,000 inhabitants and the established entrepreneurship index  $u_{ip}$  showed a positive and very high correlation. It is worth stressing at this point that the correlation between index  $u_{ip}$  and diagnostic variables  $x_1$  and  $x_2$  proved not only to be positive, but also very high, while in the case of variable  $x_3$ , the correlation power was high, and variable  $x_4$  – moderate.

Table 3. Referential values of the attractiveness synthetic index  $u_{iA}$

Group	2015 (n = 1,563)		2018 (n = 1,548)	
	range	% of communes	range	% of communes
A	$u_{iA} \geq 0.313$	16.4	$u_{iA} \geq 0.279$	16.8
B	$0.313 > u_{iA} \geq 0.253$	28.9	$0.279 > u_{iA} \geq 0.223$	30.2
C	$0.253 > u_{iA} \geq 0.193$	39.0	$0.223 > u_{iA} \geq 0.167$	37.5
D	$0.193 > u_{iA}$	15.7	$0.167 > u_{iA}$	15.5

Source: own study

At the second stage of the research, the author focused on constructing the synthetic index of rural commune attractiveness  $u_{iA}$  in relation to rural entrepreneurship. The analysis of the diagnostic features' variability showed that in the case of two of them ( $X_4$  and  $X_{12}$ ), the coefficient of the variation value was lower than 0.1. Therefore, only the remaining 19 variables were used in further study.

The analysis of data presented in Table 3 showed that, in both years in question, over half of rural communes were included in groups C and D. Moreover, in 2018, we could observe a slight increase in the percentage of communes included in groups A and B. The distribution of established groups of the attractiveness indicator in relation to enterprise development is presented in Figure 2.

Voivodship-wise, among over 50% of communes included in groups A and B, a significant change could be observed, i.e. in 2015, communes from groups A and B dominated in seven voivodeships, and in 2018 – already in eleven voivodeships. The highest percent-

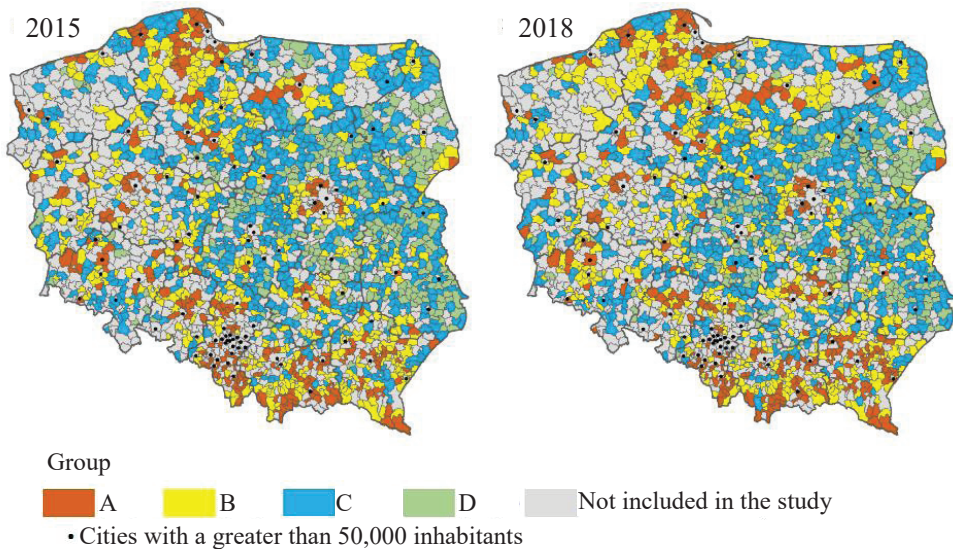


Figure 2. The spatial distribution of the synthetic index of rural commune attractiveness in 2015 and 2018

Source: own study

ages of communes which were least attractive for enterprise development in 2018 were recorded in the following voivodships: Podlaskie (87.7%), Łódzkie (85.0%), Lubelskie (84.2%), Mazowieckie (74.9%) and Warmińsko-mazurskie (52.2%). It resulted, among other things, from the well-developed agricultural function in these communes.

Although the majority of communes in the Łódzkie Voivodeship represent weak and low attractiveness for enterprise development, the rural commune of Kleszczów (the richest commune in Poland) turned out to be the best in both ratings. This, however, is an exception, slightly distorting an objective evaluation of the whole. In 2018, the group of 10 best communes included the following: Zielonki, Łodygowo, Lesznowola, Rewal, Raszyn, Solina, Stawiguda, Buczkowice and Wielka Wieś. On the other hand, the 10 communes displaying the lowest values of the indicator included: Irządze, Boćki, Brańsk, Bielsk Podlaski, Wierzbno, Regnów, Nielisz, Grabowiec, Czyże and Milejczyce.

After analysing the results of linear ordering, it can be concluded that over half of the communes included in the study (52.1%) lowered – at least by one – their position in 2018, compared to 2015. The position of nine communes did not change and in the remaining ones – it increased.

The analysis of Pearson's correlation coefficient showed a positive, moderate correlation between the number of economic entities per 1,000 inhabitants in 2018 and the attractiveness index  $u_{iA}$ . It was also found that there was a statistically significant correlation between the attractiveness index  $u_{iA}$  and the variables used to construct it. In the case of variables  $X_3$  and  $X_{21}$ , it was a negative correlation, while in the remaining cases – it was positive.

Finally, statistical analyses were conducted, the aim of which was to define the mutual dependence between the synthetic index of entrepreneurship  $u_{iP}$  and the attractiveness synthetic index  $u_{iA}$ , constructed for rural communes. The analyses showed a statistically significant positive correlation of moderate power ( $r_{2015} = 0.5697$  and  $r_{2018} = 0.5189$ ) between the indexes in question, in both years.

Furthermore, using the multiple regression method, it was established which diagnostic variables describing the attractiveness of rural communes for enterprise development, at a significance level of 0.05, had an influence on the number of economic entities per 1,000 inhabitants in 2018 ( $y$ ). Preliminary elimination analysis showed that they were variables  $X_{6-11}$ ,  $X_{15}$  and  $X_{19}$ . The estimated linear regression function was written down as an equation:

$$y = 27.25 + 0.05X_1 + 1.17X_2 - 0.01X_3 + 0.12X_5 + 0.39X_{13} + 0.26X_{14} + 0.01X_{16} - 0.003X_{17} + 0.17X_{18} + 0.01X_{20} - 6.00X_{21} \pm 15.50$$

The model of regression gives grounds for explaining, in nearly 67%, the changeability of the original dependent variable ( $R^2 = 0.666$ ). The average difference between the values of a variable that were observed and its theoretical values was 15.50. The value of statistics  $F$  and the corresponding test probability level  $p$  confirm a statistically significant linear correlation.



## CONCLUSIONS

The attractiveness of rural communes for enterprise development is the outcome of a wide -ranging impact of many social, economic, technological and environmental factors. Not all of them can be described by means of reliable statistical information, and using other data is not relevant from the point of view of scientific research. To evaluate the attractiveness of rural communes, an attractiveness indicator was constructed, based on 19 variables. The research indicated that, contrary to the opinions of some authors [Zarębski 2015], the strongest influence on enterprise development in rural communes is exerted by human factors. In the model of regression that has been constructed, they are represented by variables such as internal and external migration balance, the percentage of dwellings with bathrooms and central heating, or the share of investment expenditure in overall budget expenses. It turns out that the attractiveness of rural communes depends, primarily, on factors related to satisfying the inhabitants' necessities of life. Further development is possible due to providing a proper business environment infrastructure.

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## PRZESTRZENNE ZRÓŻNICOWANIE ATRAKCYJNOŚCI GMIN WIEJSKICH DLA ROZWOJU DZIAŁALNOŚCI GOSPODARCZEJ W POLSCE

Słowa kluczowe: rozwój przedsiębiorczości, atrakcyjność gospodarcza, rozwój społeczno-ekonomiczny, gminy wiejskie, syntetyczny wskaźnik

### ABSTRAKT

Celem artykułu jest ocena przestrzennego zróżnicowania gmin wiejskich w Polsce, z punktu widzenia ich atrakcyjności dla rozwijania działalności gospodarczej. Analizy empiryczne w tym zakresie poprzedzono przeglądem literatury przedmiotu oraz analizą dostępnych narzędzi diagnostycznych. Korzystając z wcześniejszych doświadczeń autorów, zdecydowano się wykorzystać koncepcję syntetycznego miernika atrakcyjności, prowadząc badania empiryczne w układzie czasowym i przestrzennym. Materiałem źródłowym były wybrane informacje o sytuacji gmin wiejskich w Polsce uzyskane z Banku Danych Lokalnych GUS. Do weryfikacji empirycznej posłużono się syntetycznymi wskaźnikami przedsiębiorczości ( $u_{ip}$ ) oraz atrakcyjności gmin wiejskich ( $u_{i,r}$ ), do których opracowania zastosowano metodę miary bezwzorcowej, stanowiącej średnią arytmetyczną znormalizowanych cech. Wyniki zaprezentowano w formie tabelarycznej oraz na mapkach. Wyniki przeprowadzonych badań jednoznacznie wskazały, że liczba podmiotów gospodarczych w gminach wiejskich systematycznie zwiększała się z roku na rok. Stwierdzono dodatnią istotną statystycznie korelację pomiędzy wyznaczonymi syntetycznymi wskaźnikami o umiarkowanej sile związku. Wykazano również dodatnią zależność (istotną statystycznie o umiarkowanej sile związku) pomiędzy syntetycznym wskaźnikiem atrakcyjności gmin a rozkładem przestrzennym liczby podmiotów gospodarczych. Dodatkowo, na podstawie modelu regresji stwierdzono, że liczba podmiotów gospodarczych jest determinowana w największym stopniu takimi czynnikami, jak saldo migracji, warunki mieszkaniowe oraz udział wydatków budżetowych na inwestycje.

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